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Relations Between Protein Content and Technological Quality Indices in Grains of Bread Wheat Varieties Under Different Watering Regimes

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Protein content and technological quality indices in grains of bread wheat varieties have been compared. Protein content in grains of bread wheat varieties was found to change sharply depending on watering regime. In order to evaluate the nutritional value of bread wheat varieties, sedimentation, gluten amount, gluten deformation index and grain vitreousity were determined. Vitreousity and gluten amount ranged from 22.0% to 90.0%, and from 19.2% to 28.8%, respectively, under optimal watering. Whereas, the same parameters changed between 25.0-100.0%, and 21.2-34.8%, respectively, in unwatered variants.

Keywords: *Bread wheat, productivity, protein, vitreousity, gluten, sedimentation, protein yield per hectare*

INTRODUCTION

The development of agriculture and achievement of production abundance, which is possible by increasing grain production at the expense of wheat, other cereals and grain legumes, are the main issues facing our country in the modern market economy system. Consideration of soil types is very important due to complex climatic conditions and soil properties in wheat cultivation regions. Nowadays, to obtain high-quality and high-yielding crops, organic and mineral fertilizers should be applied with consideration of ecological factors of these regions (Konovalov, 1981). Lately, diseases and pests have been widely spread in the wheat cultivation regions of Azerbaijan. Absence of measures against diseases and pests leads to loss of the production and a decline in its quality (Huseynov, 2009; Huseynov et al., 2005).

The main issue in developing a new, high-productive bread wheat variety having high quality, resistant to diseases and pests, tolerant to frost, drought and extreme environmental conditions is the construction of the complete model of wheat. Academic J.A. Aliyev laid the foundation for the new high-quality, high-yielding wheat variety model (Aliyev, 1982). The study of grain quality and technological indices related to watering regime is of great importance. Because these indices play an important role in the baking industry (Trufanov, 1994; Tutukova et al., 2011). We aimed to improve the selection methods and prepare recommendations for selectionists by studying biological and molecular properties of high-quality, high-yielding wheat varieties, tolerant to biotic and abiotic factors. Bread wheat varieties with contrasting productivity, quality, drought tolerance, resistance to diseases and pests from the local wheat genefund were planted in the Absheron Experimental Station of the Research Institute of Crop Husbandry.

Physiological and biochemical properties of high-quality grains have been studied in wheat varieites cultivated in different soil types, under contrasting climatic conditions. The possibility of application of these parameters in the selection process for developing new, high yielding, high-quality and drought-tolerant varieties has been elucidated.

MATERIALS AND METHODS

The experimens were performed in 4 replicates, in 2 variants, with 14 perspective local bread wheat varieties planted in 50m^2 beds. The nitrogen content in grains was determined in the "Keltek 1003 (LKB)" device, using the modified Kjeldahl micromethod. Coefficient N x 5.7 was used for the estimation of the protein content (Pleshkov, 1976). Grain vitreousity was measured with DZC-2 diophonoscope. For the determination of the gluten amount starch was washed out of the flour and gluten was dried and weighed. Gluten deformation index was measured with the IDK-1 device. Sedimentation was estimated after the precipitation of high-molecular protein particles in 2.0% acetic acid (QOST, 1986).

RESULTS AND DISCUSSION

To assess the nutritional capability, baking quality and quality of flour depending on water regime, grain vitreousity, gluten deformation index, sedimentation and gluten amount were determined

in bread wheat varieties. Gluten amount ranged from 19.2% to 28.8 %, gluten deformation index from 77.7 units to 97.0 units under optimal watering regime. Whereas, the same parameters changed between 21.2%-34.8%, and 84.7 units - 106.7 units, respectively, in unwatered variants.

The highest amounts of gluten was found in the bread wheat varieties Tale 38 (28.8%) and Azamatli 95 (26.8%), the smallest amounts of gluten were detected in the varieties Nurlu 99 (19.2%) and Pirshahin 1(21.2%) under optimal watering conditions. Under unwatered conditions the highest amounts of gluten were detected in the Sartovskaya 29 (34.8%) and Guneshli (28.8%) varieties, the smallest amounts in the 2 nd FAWWON N97 (21.2%) and Nurlu 99 (21.6%) varieties.Vitreousity ranged from 35.0% to 96.0% in bread wheat varieties under optimal watering regime and from 25.0% to 100.0% under unwatered conditions. Sedimentation changed from 18.0 ml to 27.0 ml under optimal watering regime, while in the unwatered variants this parameter changed between 24.0 ml and 37.5 ml.

Economic suitability index ranged from 0.26 to 0.36 and from 0.26 to 0.34 in optimally watered and unwatered variants, respectively.

Protein compounds of wheat grain were determined to elucidate the processes under the effect of biotic and abiotic factors and develop new high-yielding, high-quality varieties, tolerant to frost and drought, resistant to diseases and pests, using the purposeful selection process.

Protein content and protein yield per hectare in the bread wheat varieties cultivated under optimal watering were found to be 11.8% -13.2 % and 442.9 kg/ha-727.1 kg/ha, respectively. Whereas, these parameters ranged from 12.2 % to 15.4 % and from 381.9 kg/ha to 667.2 kg/ha, respectively, under unwatered conditions (Fig. 1).

The largest protein amounts were detected in the varieties Tale 38 (13.2%), Sartovskaya 29 (13.0%) and the smallest protein amounts were found in the varieties Giymatli 2/17 (11.8%), Akinchi 84 (11.9%), Pirshahin 1 (11.9%) under optimal watering. While under unwatered conditions, the highest values of this parameter were found in the varieties Sartovskaya 29 (14.4%), Tale 38 (13.9%), Guneshli (13.5%) and the smallest values in the varieties Ruzi 84 (12.2%), 2 nd FAWWON N97 (12.2%), Akinchi 84 (12.2%).

According to previous reports, nitrogen fertilizers in soils are insufficient for the formation of numerous protein compounds in grains of the high-productive wheat varieties (Huseynov, 2009; Marushev, 1967; Urazaliyev et al., 2003; Strelnikova, 1971; Wrigley, 1994).

Table 1. Technological quality indices of grains in regionalized and perspective bread wheat varieties under different watering regimes.

Variety	Variant	1,000-grain mass, g	Vitreousity, %	Gluten, %	GDI, units	Sedimentation, ml	Economic suitability index
Giymatli 2/17	I	53.0	31.0	23.6	95.1	19.5	0.30
	II	49.3	48.0	24.4	86.1	25.5	0.29
Akinchi 84	I	47.7	42.0	23.6	97.0	24.0	0.33
	II	47.0	76.0	26.4	100.9	31.5	0.33
Azamatli 95	I	47.1	30.0	26.8	84.7	25.5	0.31
	II	41.4	58.0	26.4	96.0	31.5	0.31
Nurlu 99	I	40.5	38.0	19.2	79.9	18.0	0.27
	II	37.0	68.0	21.6	84.7	25.5	0.29
Gobustan	I	47.1	24.0	25.5	96.4	22.5	0.34
	II	44.2	35.0	25.2	96.6	27.0	0.34
Ruzi 84	I	48.8	34.0	22.4	84.3	27.0	0.33
	II	47.8	53.0	25.2	106.7	33.0	0.32
Gyrmyzy gul 1	I	39.6	22.0	24.8	80.7	27.0	0.36
	II	39.4	25.0	22.0	85.0	25.5	0.35
Tale 38	I	46.1	40.0	28.8	96.0	27.0	0.26
	II	43.6	73.0	25.6	98.7	33.0	0.28
Pirshahin 1	I	46.8	61.0	21.2	84.5	19.5	0.32
	II	46.5	84.0	25.2	95.1	28.5	0.33
2 nd FAWWON N97	I	38.3	24.0	22.8	88.4	24.0	0.34
	II	36.1	33.0	21.2	95.2	22.5	0.32
4 th FEWSN N50	I	44.2	45.0	26.0	98.3	24.0	0.30
	II	38.7	45.0	22.8	93.3	24.0	0.30
Guneshli	I	50.6	90.0	23.2	84.4	24.0	0.26
	II	46.3	100.0	28.8	95.2	31.5	0.26
Daghdash	I	38.8	81.0	23.2	77.7	22.5	0.27
	II	36.6	81.0	26.0	92.6	24.0	0.27
Sartovskaya-29	I	47.2	89.0	25.2	86.9	25.5	0.28
	II	44.5	91.0	34.8	92.0	37.5	0.28

I - optimal watering regime; **II** – unwatered variant

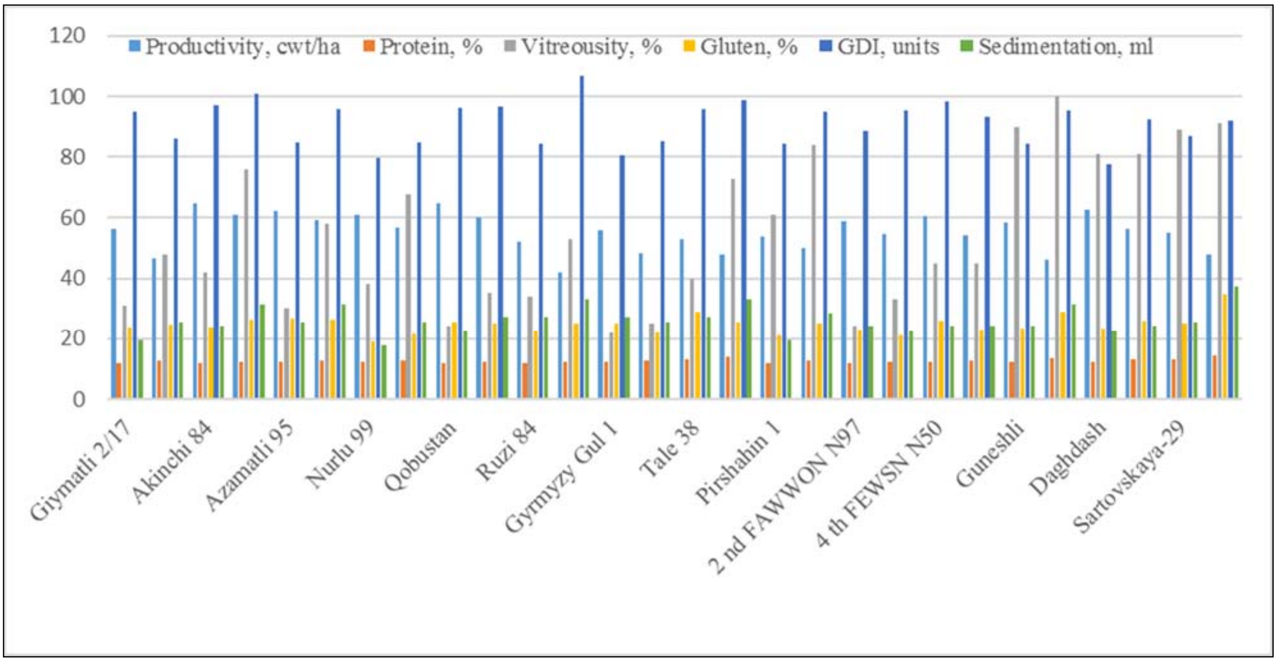


Fig. 1. Comparison of grain quality indices of regionalized and perspective bread wheat varieties under different watering regimes.

Table 2. Comparison of grain quality indices of regionalized and perspective bread wheat varieties under different watering regimes.

	Productivity, cwt/ha	Protein,%	Protein yield, cwt/ha	1000 grain mass,g	Vitreousity, %	Gluten, %	GDI, units	Sedimen-tation, ml
Protein,%	-0.509**							
Protein yield, cwt/ha	0.908**	-0.104						
1000 grain mass, g	-0.122	-0.170	-0.232					
Vitreousity, %	-0.274	0.553**	-0.041	0.100				
Gluten, %	-0.246	0.694**	0.044	0.242	0.389*			
GDI, units	-0.197	0.178	-0.146	0.237	0.060	0.403*		
Sedimentation, ml	-0.516**	0.682**	-0.268	0.099	0.422	0.741	0.461*	
Economic suitability index	0.146	-0.477*	-0.072	-0.056	-0.619**	-0.238	0.113	-0.023

*0.01 accuracy, ** 0.05 accuracy

Considering the lack of protein compounds in flour and flour products, and the increasing demand of population for plant proteins, correlations between technological quality indices of different bread wheat varieties have been studied.

A negative correlation (-0.509**) was found between productivity and portein amount in grains of the studied bread wheat varieties. A positive correlation (0.908**) exists between productivity and protein yield per hectare and a weak negative correlation (-0.104) was detected between protein yield per hectare and protein amount in grains. Positive correlations were also observed between protein amount in grains and vitreousity (0.553**), gluten amount (0.694**), sedimentation (0.682**) and a negative correlation between protein amount and Economic suitability index (-0.477*) (Table 2).

Considering the positive correlations between protein amount, productivity and protein yield per hectare, valuable recommendations can be given to selectionists for developing new, high-productive and high-quality bead wheat varieties.

REFERENCES

Aliyev J.A. (1982) Ideal wheat plant. *Agricultural Science* news (Baku), **No 5:** pp.13-19 (in Azerbaijani).

Huseynov S.I. (2009) Drought tolerant and high-quality wheat samples. *Journal of Azerbaijan Agricultural Sciences*, **No 1-2:** pp.58-59 (in Russian).

Huseynov S.I., Talai J.M., Abdulbagiyeva S.A., Mahmudov R.U. (2005) Selection of perspective wheat varieties, distinguished by their productivity and quality indices for the cultivation under rainfed conditions. *Transactions of Azerbaijan Research Institute of Crop Husbandry*, **21:pp.** 206-211 (in

Azerbaijani).

Konovalov Y.B. (1981) Forming the productivity of the ear of spring wheat and barley. M.: Kolos, 175 p. (in Russian).

Marushev A.I. (1967) Value of the quantity and quality of protein in wheat grain when assessing their technological properties. In: *Techniques and methods for improving the grain quality in cereal crops*. L.: Kolos, pp. 225-236 (in Russian).

Methodological guidelines for assessing the quality of cereals and oil cultures (1986) Moscow: 23 p. (in Russian).

Pleshkov B.P. (1976) Workshop on plant biochemistry. M.: Kolos, 256 p.

Strelnikova M.M. (1971) Improving the quality of wheat grain. Kiev: Urozhay, p.180 (in Russian).

Trufanov V.A. (1994) Wheat gluten and quality problems. *Sib. Institute of Plant Physiology and Biochemistry*. Novosibirsk: Science. Sib. pub. “Firma”, 367 p. (in Russian).

Tutukova D.A., Malkanduyev Kh.A., Malkanduyeva A.Kh. (2011) Influence of the level of mineral nutrition on the productivity and quality of grain of new varieties of winter wheat under conditions of vertical ash content of Kabardino-Balkaria. *Bulletin of Orlov State Agrarian University*, **4(31): pp.**7-10 (in Russian).

Urazaliyev R.A., Ashirbayeva S.A., Abugaliyeva A.I. (2003) Winter durum wheat: Quality of grains, yield and stability of their formation. *Quality of wheat grain in Central Asia*. SIMMYT, pp. 79 -83 (in Russian).

Wrigley C.W. (1994) Developing better strategies to improve grain quality for wheat. *Aust. J. Agric. Res*., **45: pp.** 1-17.

Suvarma Rejimindən Asılı Olaraq Yumşaq Buğda Sortlarının Dənində Zülalın Miqdarı ilə Texneloji Keyfiyyət Göstəricilərinin Əlaqəsi

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Məqalədə yumşaq buğda sortlarının dənində zülalın miqdarının texnoloji keyfiyyət göstəriciləri ilə müqayisəli təhlili verilmişdir. Aparılmış tədqiqatlar nəticəsində məlum olmuşdur ki, suvarma rejimindən asılı olaraq yumşaq buğda sortlarının dənində zülalın miqdarı kəskin surətdə dəyişir. Suvarma rejimində asılı olaraq yumşaq buğda sortlarının qidalılıq dəyərini öyrənmək üçün dəndə sedimentasiyanın, keykovinanın miqdarı, İDK və şüşəvarilik öyrənilmişdir. Tədqiq olunan yumşaq buğda sortlarının dənində optimal suvarma variantında şüşəvarilik (22,0-90,0%), kleykovinanın miqdarı isə (19,2-28,8 %), Suvarılmayan variantda isə bu göstərici uyğun olaraq (25,0-100,0%), (21,2-34,8 %) arasında dəyişmişdir.

Açar sözlər: *Yumşaq buğda, məhsuldarlıq, zülal, Şüşəvarilik, kleykovina, sedimentasiya, hektardan zülal çıxımı.*

Отношение Между Содержанием Белка и Показателями Технологического Качества в Зернах Сортов Мягкой Пшеницы при Различных Режимах Полива

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Проведено сравнение содержания белка и показателей технологического качества зерна сортов мягкой пшеницы. Обнаружено, что содержание белка резко меняется в зависимости от режима полива. Для оценки пищевой ценности сортов мягкой пшеницы были определены седиментация, содержание клейковины, индекс деформации клейковины и стекловидность зерна. При оптимальном поливе изменения стекловидности и количества клейковины составляли 22.0% - 90.0% и 19.2%-28.8% соответственно. Однако, в вариантах без полива эти параметры менялись в пределах 25.0-100.0% и 21.2-34.8%, соответственно.

Ключевые слова: *Мягкая пшеница, продуктивность, белок, стекловидность, клейковина, седиментация, выход белка с 1 га*